

At right, scientist Nancy Defeo of the University of New Hampshire's Institute for the Study of Earth, Oceans and Space (EOS) is processing Landsat Thematic Mapper data as part of an investigation to determine the efficacy of satellite information in detecting forest decline damage which may be due to acid rain or other atmospheric pollutants.

Defeo is part of a vegetation remote sensing group that has been investigating the matter for several years under the sponsorship of NASA's Jet Propulsion Laboratory (JPL). The research is headed by Dr. Barrett Rock (center), former leader of JPL's Geobotanical Remote Sensing Group, now with EOS.

The Thematic Mapper (TM), developed by Hughes Aircraft under NASA contract, is an advanced scanning instrument aboard Landsats 4 and 5, which were initially developed by NASA and are now operated as a commercial remote sensing system. The TM detects radiations reflected and emitted from Earth objects—such as trees—in seven bands of the spectrum. Since each object has its own unique spectral “signature,” the TM can distinguish among surface features and generate computer-processed imagery identifying specific

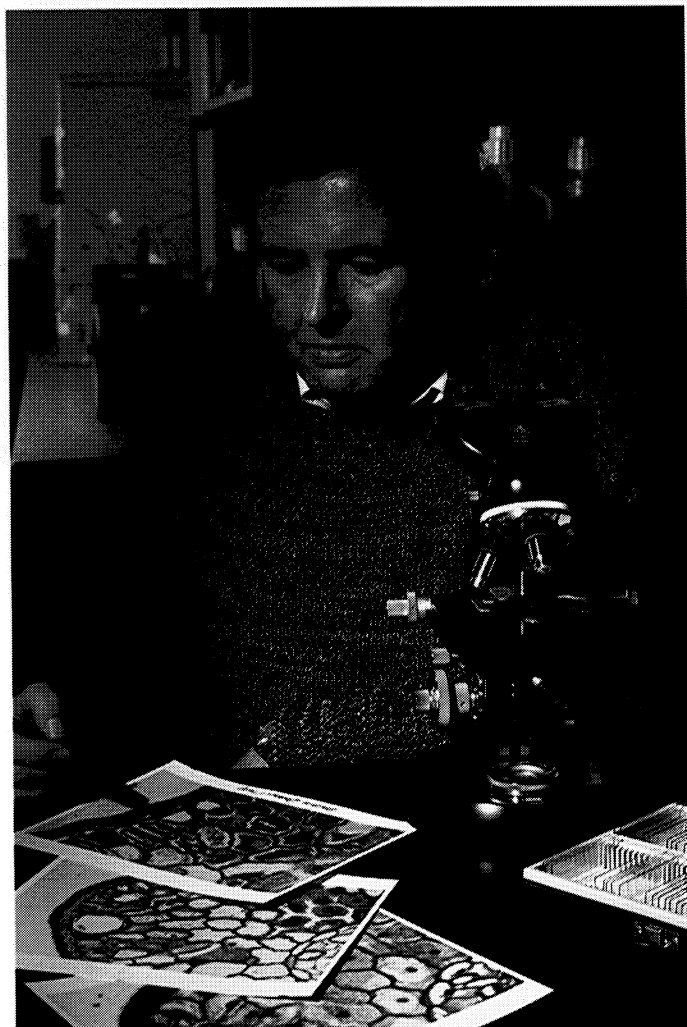
features of importance to resources managers.

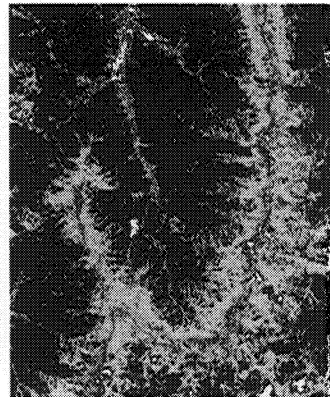
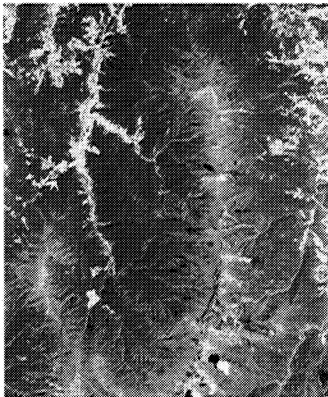
Since the early 1960s, the high-elevation spruce/fir forests of the northeastern United States have undergone a marked decline in growth rate and state of health. During the same period, there has been similar decline in central European forests of spruce, fir and beech. Remote sensing satel-

lites are capable of detecting, identifying and quantifying forest decline to make possible forest monitoring and assessment on a global scale. Advanced satellite instrumentation planned for the 1990s may even be able to identify spectral “fingerprints” that would enable investigators to identify specific causes of forest damage and decline. Scientists at EOS are trying to demonstrate how accurate satellite observations may be in detecting specific levels of forest damage.

Toward this goal, Dr. Rock's NASA group has conducted multiyear forest decline investigations using satellite and aircraft-acquired imagery. This work was coordinated with “ground truth” field investigations to check the accuracy of scanner data.

The NASA group, which included Dr. James E. Vogelmann (EOS), Dr. Ann F. Vogelmann (EOS), Takashi Hoshizaki (JPL), and Darrell L. Williams of Goddard Space Flight Center, has conducted research on New York's Adirondack Mountains, the Green Mountains of Vermont and the White Mountains of New Hampshire. In addition, Dr. Rock's group and scientists from North Caro-





can be used accurately and efficiently to detect, quantify, map and monitor areas of forest damage on a regional scale."

Satellite imagery has been incorporated into the U.S. Forest Service's routine damage assessment fieldwork in the southeastern United States to further check the accuracy of satellite damage assessment imagery and to

lina State University have conducted a joint study, sponsored by the U.S. Forest Service, to assess forest decline damage on Mt. Mitchell in North Carolina.

Shown above is a TM damage assessment image of Mt. Mitchell; the green areas are healthy conifer (evergreen) and hardwood (broadleaf) trees, yellow shows moderate damage, orange severe damage. At upper right, the same image has been computer manipulated to help identify specific problems; here blue represents healthy trees and the other colors show increasing levels of damage in yellow, orange and white. At right, a group is conducting a ground truth check of a white-colored (highly damaged) area identified in the image. At far right, some of the researchers compare notes, left to right, Nancy Defeo, Barrett Rock and James Vogelmann.

The group's research has



been "very encouraging." The levels and distribution of forest damage detected using satellite and aircraft imagery corresponded very well with conventional ground-based measurements of forest health. "We are now confident," said Dr. Rock, "that satellite imagery

acquaint foresters with the use and potential of such imagery. ▲

